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EOSDIS Core System Project

Release B COTS Maintenance Plan for the ECS Project

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Hughes Information Technology Systems
Upper Marlboro, Maryland

Release B COTS Maintenance Plan for the ECS Project

May 1996

Prepared Under Contract NAS5-60000
CDRL Item 119

SUBMITTED BY

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Preface

This document is a formal contract deliverable with an approval code 1 and is intended as a final submittal. It requires Government review and approval prior to acceptance and use. Once this document is approved, Contractor approved changes are handled in accordance with Class I and Class II change control requirements described in the EOS Configuration Management Plan, and changes to this document shall be made by document change notice (DCN) or by complete revision.

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Abstract

This COTS Maintenance Plan addresses the Release B maintenance concept and the responsibilities of the ECS Project for the commercial off-the-shelf hardware and software supplied by the ECS Contractor and government furnished equipment (GFE). The plan identifies the sources of maintenance support at ECS sites, periods of coverage, and responsibilities of the M&O staff and contracted maintenance providers. ECS sites included for maintenance support include GSFC, LaRC, EDC, JPL, NSIDC, ASF, ORNL, and the EDF.

Keywords: Maintenance, PPM, support, LMC, diagnostics, corrective, preventive, PM, operational, availability, LRU, spares, provisioning, problem, resolution.

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1. Introduction

1.1 Identification of Document

This document, Contract Data Requirements List (CDRL) Item 119, whose requirements are specified in Data Item Description (DID) 613/OP1, is a required deliverable under the Earth Observing System Data and Information System (EOSDIS) Core System (ECS), Contract (NAS5-6000).

1.2 Scope of Document

This document applies to all Commercial Off-The-Shelf (COTS) hardware (HW) and software (SW) supplied by the ECS Contractor. It defines the responsibilities of the ECS Project organization for the maintenance of COTS products at seven Release B distributed active archive centers (DAACs), EOS Operations Center (EOC), System Monitoring and Coordination Center (SMC), and the ECS Development Facility (EDF). This document lays the foundation for implementing and managing the COTS HW and SW maintenance for the ECS during Release B

This document reflects the February 14, 1996 Technical Baseline maintained by the contractor configuration control board in accordance with ECS Technical Direction No. 11, dated December 6, 1994.

1.3 Purpose and Objectives of Document

This document describes the general concept and plan for maintaining ECS commercial-off-the-shelf (COTS) HW and SW in support of ECS objectives. It is applicable to the maintenance support of ECS COTS HW and SW from initial product installation until maintenance responsibility is transferred to NASA or its designated follow-on maintenance contractor. This document describes the responsibilities of the ECS contractor, original equipment manufacturers, and third party maintenance contractors in providing maintenance support to the ECS project.

1.4 Document Status and Schedule

This document submittal addresses the CDRL requirement for the SDPS /CSMS and FOS Release B Critical Design Reviews (CDRs), and is intended as a final submittal for Release B data. It is anticipated that the next submittal of DID 613 will contain Release C data and is scheduled for the CDR-C time frame.

1.5 Document Organization

The contents of the document are as follows:

Section 1: Introduction - Introduces the COTS Maintenance Plan scope, purpose and objectives, status and schedule, and document organization

Section 2: Related Documentation - Describes the parent, reference, and applicable documents useful in understanding the details of subjects discussed in this document.

Section 3: System Description - Describes the ECS conceptual architecture and operational requirements.

Section 4: Technical Approach - Describes the maintenance objectives, organization, responsibilities, and approach to maintenance of ECS COTS equipment and software

Section 5: Configuration Management and Data Management - Identifies the applicable configuration and data management processes.

Section 6: Certification and Training - Describes the certification criteria for maintenance functions.

Section 7: Safety - Discusses the applicable safety practices, standards, and procedures.

2. Related Documentation

2.1 Parent Documents

The following documents are the parents from which the scope and content of this COTS Maintenance Plan derive:

102-CD-001-004	Development Configuration Management Plan for the ECS Project, Revision 1
102-CD-002-001	Maintenance and Operations Configuration Management Plan for the ECS Project
420-05-03	Goddard Space Flight Center, Earth Observing System (EOS) Performance Assurance Requirements for the EOSDIS Core System (ECS)
423-41-01	Goddard Space Flight Center, EOSDIS Core System (ECS) Statement of Work
423-41-02	Goddard Space Flight Center, Functional and Performance Requirements Specification for the Earth Observing System Data and Information System (EOSDIS) Core System (ECS)

2.2 Applicable Documents

The following documents are referenced within this COTS Maintenance Plan or are directly applicable, or contain policies or other directive matters that are binding upon the content of this document.

STDN 402	Goddard Space Flight Center, NASA System Maintenance Program
500-TIP-2110	Goddard Space Flight Center, Mission Operations and Data Systems Directorate (MO&DSD) Technical Information Program (TIP) Specifications for Document Formats
none	Goddard Space Flight Center, ECS Integrated Logistics Support Plan
MIL STD 1388-1A	Military Standard: Logistics Support Analysis
DOD-STD-1686	Department of Defense Standard: Electrostatic Discharge Control Program for Protection of Electrical and Electronic Parts, Assemblies, and Equipment

2.3 Information Documents

The following documents are referenced herein and, amplify or clarify the information presented in this document. These documents are not binding on the content of this COTS Maintenance Plan.

102-CD-002-001	Maintenance and Operations Configuration Management Plan for the ECS Project
194-207-SE1-001	System Design Specification for the ECS Project
302-CD-003-001	Release B GSFC Facilities Plan for the ECS Project
101-303-DV1-001	Individual Facility Requirements for the ECS Project
305-CD-020-002	Release B SDPS/CSMS Design Specification Overview for the ECS Project
501-CD-001-004	Performance Assurance Implementation Plan for the ECS Project
513-CD-002-001	Release B Hazard Analysis for the ECS Project
516-CD-002-002	Release B Reliability Predictions for the ECS Project
517-CD-001-004	Failure Modes and Effects Analyses (FMEA) and Critical Items List (CIL) for the ECS Project
532-CD-002-001	Release B Environmental Control Plan for the ECS Project
601-CD-001-004	Maintenance and Operations Management Plan for the ECS Project
194-602-OP1-001	Property Management Plan for the ECS Project
604-CD-001-004	Operations Concept for the ECS Project: Part 1-- ECS Overview
604-CD-002-003	Operations Concept for the ECS Project: Part 2B -- ECS Release B
604-CD-003-001	Operations Concept for the ECS Project: Part 2A -- ECS Release A
604-CD-004-001	Operations Concept for the ECS Project: Part 2 -- FOS
605-CD-002-001	Release B SDPS/CSMS Operations Scenarios for the ECS Project
607-CD-001-002	ECS Maintenance & Operations Positions Descriptions for the ECS Project
608-CD-001-002	ECS Operations Plan for Release B
609-CD-001-001	Interim Release 1 (Ir1) Maintenance and Operations Procedures for the ECS Project
611-CD-001-001	Interim Release 1 (Ir1) Operator's Manual for the ECS Project
614-CD-001-003	Developed Software Maintenance Plan for the ECS Project
615-CD-002-001	Release B Special Maintenance and Test Equipment for the ECS Project

616-CD-002-001	Release B Integrated Support Plan for the ECS Project
617-CD-002-001	Release B Logistics Support Analysis Plan for the ECS Project
618-CD-002-001	Release B Replacement and Spare Parts List for the ECS Project
619-CD-001-001	Release B Test and Support Equipment Requirements for the ECS Project
622-CD-001-002	Training Plan for the ECS Project

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3. System Description

3.1 System to be Supported

Release B, including its incremental releases, is the second fielding of COTS products for the ECS. ECS is the geographically distributed ground system network of hardware (HW) and software (SW) for the collection, processing, storage, and distribution of data obtained from a system of space platforms as well as storage and distribution of selected non-EOS data sets of the ECS. ECS also supports the operation and management of the EOS in-orbit payloads, US observatories and the interaction of its components. The overall ECS is an expandable, technology adaptable and modularly designed hierarchy of segments, elements, subsystems and components.

3.1.1 Functions of ECS Segments

The ECS is composed of three functional segments that are arranged into two of the three organizational components for managing their development. The functional segments are: The Flight Operations Segment (FOS), the Science Data Processing Segment (SDPS), and the Communications and Systems Management Segment (CSMS). Each segment has unique functions and availability requirements. The ECS, with its components and interfaces, is depicted in Figure 3.1.1-1, ECS Conceptual Architecture.

The Flight Operations Segment (FOS) manages and controls the EOS-AM1 space platform and instruments (observatory). The FOS contains the most time-sensitive functions and is composed of two elements. The EOS Operations Center (EOC) plans, schedules, controls and monitors EOS mission operations and the EOS observatory. Instrument Support Toolkits (ISTs) schedule, command, and operate the science instruments and monitor instrument performance.

SPDS provides a set of processing, archival, and distribution elements for science data and a data information system for the entire ECS. SPDS consists of seven subsystems: 1) client, 2) interoperability, 3) data management, 4) data server, 5) ingest, 6) planning and 7) data processing. Together, these subsystems support the services required to receive, process, archive and manage the NASA Probe flight missions, EOS-AM1 space platform and instruments, other selected remotely sensed data, and their associated data products.

CSMS provides overall ECS management and operation of the ground system resources, facilities, and networking services. It consists of 3 subsystems: 1) the Communications Subsystem (CSS), which is a collection of services providing flexible interoperability and information transfer between clients and servers; 2) the Internetworking Subsystem (ISS), which is the layered stack of communications services consisting of the data link and physical services, the network services, and the transport services; and 3) the Management Subsystem (MSS) which is a collection of applications that manages all ECS resources. Using these functions, the SMC will monitor and coordinate the operations of the ground system resources, facilities and communications network

and interfaces to NASA's EOS Backbone Network (EBnet). The EBnet provides a dedicated communications network and services for interconnections of the ECS and non-ECS facilities within the EOS Program.

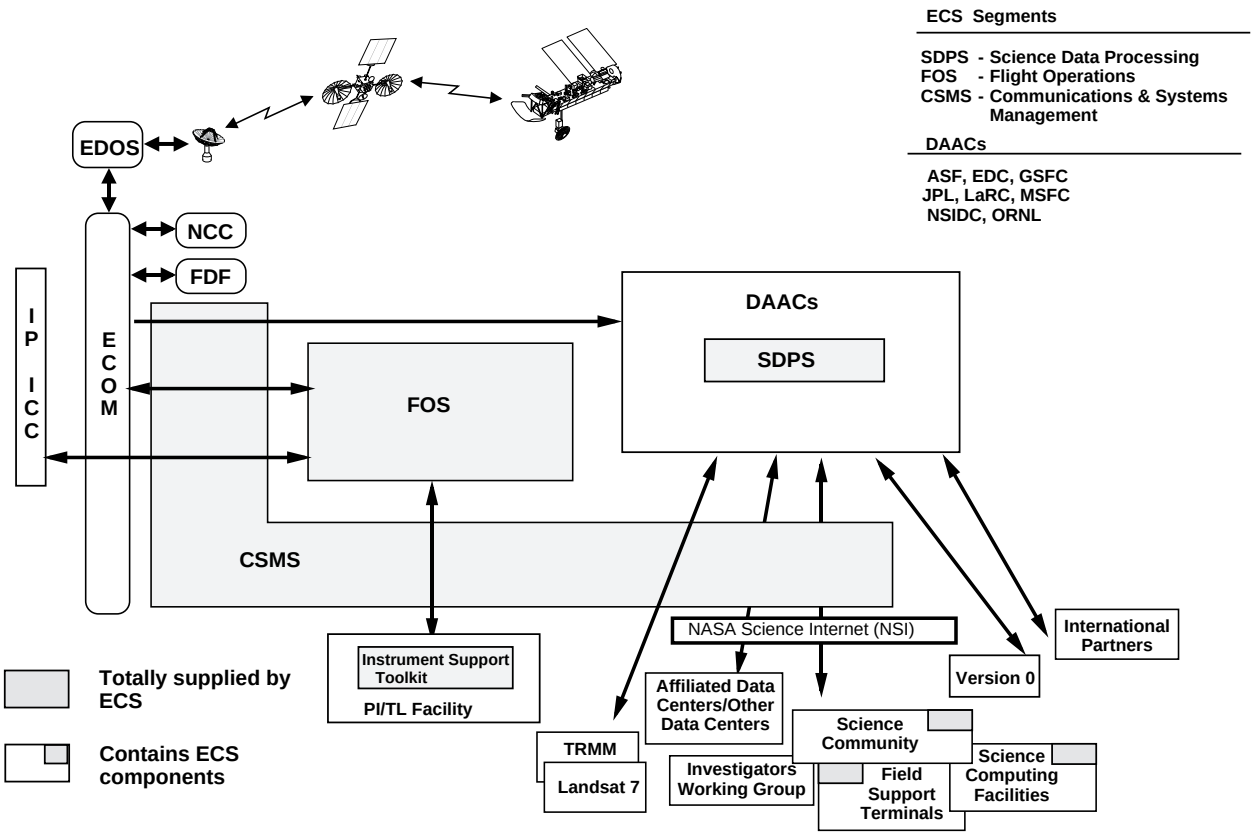

Figure 3.1.1-1. ECS Conceptual Architecture

3.1.2 Equipment to be Supported

The ECS is comprised of COTS HW and SW, ECS-developed applications, government furnished equipment (GFE), and science SW. This equipment includes UNIX workstations, servers, supercomputers, robotics storage subsystems; communications components (i.e., concentrators, routers, bridges); and various computer peripherals. The makes, models, and quantities of ECS equipment to be supported at each site are shown in Table 3.1.2-1. This equipment and quantities may change somewhat as a result of post-CDR-B decisions. This equipment and software is described in the Release B SDPS/CSMS Design Specifications (DID 305 series) delivered for the Release B Critical Design Review (CDR).

Table 3.1.2-1. ECS Equipment List (1 of 2)

Product	Model	Vendor	ASF	EDC	EOC	GSFC	JPL	LaRC	NSIDC	ORNL	SMC	Total
HIPPI Switch (12 Port)	ESP 16	Nw Sys	2	1		11	2	4	2			22
FDDI Switch/Router 7000	7310	Alantec	1	1	1	1	1	1	1	1	1	9
3480 Dr w/ACL	T480DA	Archive	1	1		1	1	1	1			6
FDDI Concentrator	2914-04	Bay Nwks	5	8	8	12	10	13	8	5		69
Ethernet Switch/Hub	Micromac-22E	Cabletron	1	2	8	2	1	1	1	1	1	18
Copier	NP 30-50	Cannon	1	1		2	1	2	1	1		9
Router FDDI	7010	Cisco	1	1		1	1	1				5
Router W/SW-XSA-GS	HSN-802.6	Cisco							1			1
FDDI To Enet LAN Bridge	TBD	Cisco	2	3		10	3	3	2			23
Time Server	Tymeserv 1000	Datum			2							2
Data/File Svr (Rack Mtd)	Alpha 1000 4/233	DEC			9							9
Server Rack	Rack /DEC ALPHA	DEC			4							4
1600/6250 BPI Tp Drv	TU81E-SA	DEC	1	1			1		1			4
4mm Tp Stkr w/4 Dr	Spectra 4000/20	ECCS	1	1		1	1	2	1			7
Archive Tape Library	ABBA/2-(9'3")	EMASS				1		3	1			5
Archive Tape Library	ABBA/E	EMASS	1			1	2	1				5
Tape Stacker (8mm)	210TW/8505S	Exabyte	1	3		8	4	4	2			22
Impact Printer	3480	Genicom		1		1	1	1	1	1		6
Line Printer	4490XT	Genicom			5							5
Workstation	C-100	HP	1	1			1		1	1		5
Color Printer-Laserjet	Color Laserjet	HP			5							5
Workstation	715/64	HP				1		1				2
Server	9000 J	HP	2	2		2	2	2	3	2	2	17
Server	9000 K	HP	1	1	2	2	1	1		1		9
RAID w/81-160GB (4.3DR)	9000 MOD	HP	1			3						4
RAID w/1-40GB (2.1DR)	9000 MOD 10	HP		1		4	2	5	1		1	14
RAID w/41-80 GB (4.3DR)	9000 MOD 20	HP		1		4			1			6
Laser Printer 12ppm	Laserjet 4M+	HP	3	4	6	13	5	6	6	1	1	45
Scanner	TBD	HP		1		1	1	2	1			6
Server Console	TBD	HP	1	1			1		1			4
3490 Tbl Top Tp Drv	E01	IBM	1	1		1	1	1	1			6
Linear Mag Drv	NTP	IBM				5						5
CD-ROM Jukebox	Disk Transp.	Kodak	1	1			1	1	1			5
Server	Challenge DM	SGI		2		1		1	1			5
Processor	Challenge L	SGI	4			6	7	4	5	2		28
RAID (1-40 GB)	Chal. RAID (2.1DR)	SGI	2	3		27	17	9	4	3		65
RAID (161-240GB)	Chal. RAID (4.3 DR)	SGI									2	2
RAID (41-80GB)	Chal. RAID (4.3DR)	SGI	1	2					1			4
RAID (81-160GB)	Chal. RAID (4.3DR)	SGI		5		9	5	4			12	35
Sci. Processor/Server	Power Challenge XL	SGI	3	9		6	5	14				37
Workstation	Indy	SGI										
Server	INDIGO2	SGI		1		4	1	2	1			9
Server Console	TBD	SGI				1				1		2

Table 3.1.2-1. ECS Equipment List (2 of 2)

Product	Model	Vendor	ASF	EDC	EOC	GSFC	JPL	LaRC	NSIDC	ORNL	SMC	Total
Archive Tape Library	Powderhorn 4400	Stk		5		11		1			1	18
Workstation/Server	SPARC 20/50	Sun	6	17	1	43	9	32	14	2	1	125
RAID (1-60 GB)(2.1DR)	SPARCStor100	Sun	3	2	1	4	1	1	1			13
RAID (121-240GB)(4.3DR)	SPARCStor 200 (2ea)	Sun		1		4		3	1			9
Workstation/Server	SPARC 20/71	Sun	1	19	5	109	10	19	9			172
Server	SPARC 20/712	Sun	1	1		12	5	8	1	2	2	32
Server/Workstation	ULTRA 140 and 170	Sun	9	13	32	3	8	13	11	3	1	93
3590 Tape Drive	TBD	TBD				2		8				10
Comm. Rack	24"W/30"D/72"H	TBD	2	2		2	2			2		10
DLT Stacker	TBD	TBD	1	1		1	1	1	1	1	1	8
Facsimile	TBD	TBD	1	1		1	1	1	1			6
LAN Analyzer	TBD	TBD	2	2		2	2	2	2	1		13
Projector	TBD	TBD				4						4

3.1.3 ECS Locations

The ECS equipment to be supported will be located at the following NASA Distributed Active Archive Centers as well as the ECS Development Facility (EDF) located in Upper Marlboro, MD.:

a. Goddard Space Flight Center (GFSC), Greenbelt, Maryland, (includes EOC and SMC)

b. Earth Resources Observation Systems (EROS) Data Center (EDC), Sioux Falls, South Dakota

c. Langley Research Center (LaRC), Hampton, Virginia

d. University of Colorado, National Snow and Ice Data Center (NSIDC), Boulder, Colorado

e. University of Alaska Synthetic Aperture Radar (SAR) Facility (ASF), Fairbanks, Alaska

f. Jet Propulsion Laboratory (JPL), Pasadena, California

g. Oak Ridge National Laboratory (ORNL), Oak Ridge, Tennessee (software only)

Additional DAAC locations may be incorporated into the ECS as operational needs warrant. ECS equipment will be located in facilities belonging to a sponsor (host) organization, which provides space for maintenance administration, spare parts, tools, and consumables storage in accordance with the Release B ECS Facilities Plan for each DAAC (DID 302 series).

The ECS Development Facility (EDF) is the facility where the ECS Contractor designs the ECS and develops its component applications. The SMC and EOC are co-located with the GSFC DAAC in Bldg. 32, GSFC. The SMC monitors and coordinates ECS operations. The EDF, SMC, and the EOC are also supported by the maintenance program described in this plan. During Release B equipment installation and test, the diagnosis and resolution of COTS HW and SW problems are resolved by the installation team and COTS vendors, which provide 1-year warranty for COTS products.

3.2 Operations and Maintenance Requirements

ECS Release B operations will commence at Release Readiness Review, which is September 1, 1997. Once operations commence, maintenance support to the DAACs, SMC, and EOC will be consistent with the operations requirements of ECS-supported missions (e.g., TRMM, Landsat-7, AM-1, etc.). Planned operations schedules are identified in the ECS Operations Plan for Release B, (DID 608). Specific DAAC operations hours are established by the DAAC managers.

Because of the higher costs of maintenance support during extended operations hours (i.e., nights, weekends, and holidays), maintenance engineer presence during these periods will be limited to that required to sustain mission-critical operations and to satisfy ECS Ao and MDT requirements. Generally, the principal period of maintenance (PPM) at the DAACs, EOC, SMC, and EDF will be 8AM to 5PM local, Monday through Friday, excluding local holidays. Maintenance support provided outside the PPM will depend on the criticality of the failure and the response required to satisfy the ECS operational availability (A_O) and Mean Down Time (MDT) requirements described below.

3.3 Operational Availability (A_O) and Mean Down Time (MDT)

The ECS A_O and MDT requirements differ between the FOS, SDPS, and CSMS functions, depending on the criticality of the function involved. Generally, critical functions are those associated with the FOS real-time functions that support launch and some CSMS functions described below.

FOS critical functions of the EOC include early orbit checkout; disposal; orbit adjustment; anomaly investigation; recovery from safe mode; routine real-time commanding and associated monitoring for spacecraft and instrument health and safety.

CSMS critical services are those necessary to ensure the SMC can operate on a 24-hour-per-day basis and those necessary for interaction with the ECS element to maintain the ECS mission. Equipment that makes up the critical ECS functions are identified in the Release B SDPS/CSMS Design Specifications (DID 305 series), which identify the function threads, and in the Release B Reliability Predictions (516-CD-002-002), which provides the predicted operational availability (Ao) and mean down time (MDT) for the function threads.

DAAC SDPS functions (i.e., product generation) are required to operate in a fail-soft environment. In that environment, when a component fails the function continues in a degraded mode because the remaining systems continue to produce products. Therefore, SDPS functions are not considered to have critical components.

COTS HW and SW failures that support ECS critical functions will be assigned highest priority for maintenance actions in the trouble ticket, immediately acted upon and reported to SMC and/or EOC management. The specific A_O and MDT objectives for the segments and functions within segments are stated in the ECS Function and Performance Requirements Specification, Section 5 and are shown in Table 3.3-1, ECS Operations Requirements. These requirements do not accrue to individual components, but to the system and sub-systems as indicated in the table.

3.4 Human Engineering Factors

Because the ECS is a COTS-intensive system, human engineering factors (human-machine interface) have been incorporated by equipment manufacturers into COTS product designs. Human-machine interface factors were considered by the ECS development organization in the design of the system, selection of COTS products, and development of the custom software. Human-machine interface factors are also considered in facility planning.

3.5 Standardization of Support Equipment

Where it was determined to be beneficial to the ECS Project, equipment and SW was standardized to minimize operations, training, and support costs.

Table 3.3-1. ECS Operation Requirements

Function Number	Function Description	Ao Minimum	MDT Maximum
	Flight Operations Segment (FOS)		
3800	Critical Real Time Functions	0.9998	1 Min.
3810	Non Critical Real Time Functions	0.99925	5 Min.
3820	Targets of Opportunity	0.992	1 Hr
3700	Observatory Real Time Operations Functions	0.96	4Hrs
3710	ECS shall have no single point of failure for functions associated with real time operations of the spacecraft and instruments		
	Science Data Processing Segment (SDPS)		
3900	Data Receiving	0.999	2 Hrs
3910	Switch over to Backup	NA	15 Min.
3920	Archiving & Distributing Data	0.98	2 Hrs
3930	User Interface to IMS at DAACs	0.993	2 Hrs
3940	Information Searches on the ECS Directory	0.993	2 Hrs
3950	Data Acquisition Request Submittals	0.993	2 Hrs
3960	Metadata Ingest and Update	0.96	4 Hrs
3970	Info Searches on Local Holdings	0.96	4 Hrs
3980	Local Data Order Submission	0.96	4 Hrs
3990	Data Order Submission Across DAACs	0.96	4 Hrs
4000	IMS Data Base Management and Maintenance Interface	0.96	4 Hrs
4010	Product Generation Computers	0.95	NA
4020	Product generation computers shall provide a "Failsoft" environment		
	Communications and System Monitoring Segment (CSMS)		
5.6.4.3	Critical Services: Configuration Management, Resource Management, Performance Management Service, Report Generation, Accounting/Accountability, Fault Management, Security Management, and Directory Services	0.998	20 Min.
5.6.4.3	Non Critical Services: Scheduling services and non-critical CM services	0.96	4 Hrs
4030	SMC functions of Gathering and Disseminating System Management Information	0.96	4 Hrs
4035	ESN shall have no single point of failure for functions associated with network databases and configuration data		
4036	ESN A_O shall be consistent with the Ao of the ECS functions.		
3630	Maximum down time shall not exceed twice the required MDT in 99 percent of failure occurrences		

A_O = Operational Availability

MDT= Mean Down Time

3.6 Environmental and Facility Requirements

ECS COTS HW will be operated in an environment that is dust, temperature, and humidity controlled. Because of the sensitivity of data media to these elements, ECS data is archived in a restricted-access, controlled environment separate from the operations areas. These requirements are addressed in the ECS Facilities Plans (DID 302) and the Environmental Control Plan (DID 532).

Some DAAC sites will have Government furnished and maintained uninterruptable power supplies (UPS) to provide immediate backup power in the event of a power outage. These UPS systems should have the capacity to sustain power to ECS systems for twenty minutes to allow graceful shutdown of equipment and shifting to auxiliary power sources, if available.

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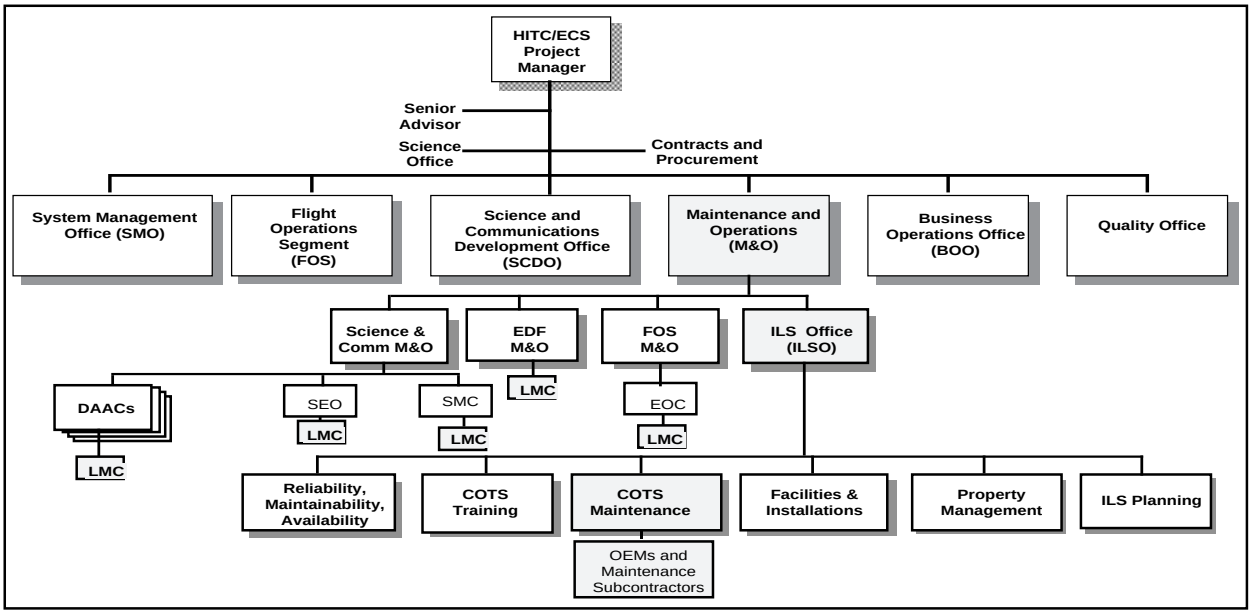
4. Technical Approach

4.1 Maintenance Objective

The primary objective of ECS maintenance operations is to achieve and sustain the operational availability (A_O) and mean down time (MDT) objectives (Table 3.3-1) of the ECS at the least life cycle cost.

4.2 Maintenance Organization

Working under the general direction of the Maintenance and Operations (M&O) Manager, the Integrated Logistics Support (ILS) Manager manages the ECS COTS maintenance program and other logistics operations depicted in Figure 4.2-1, "COTS Maintenance Organization." This includes the budget and expenditures associated with COTS HW and SW maintenance and the provisioning of spares in support of maintenance operations. The ILS Office (ILSO) assists ESDIS in the development of ECS COTS HW and SW maintenance policy; monitors and coordinates maintenance operations at the ECS sites; and manages maintenance support provided by vendors and OEMs. Daily management and execution of DAAC, SMC, and EOC HW and SW maintenance is under the operational control of the DAAC, SMC, and EOC managers. Each site has a designated local maintenance coordinator (LMC) who executes maintenance support at the site, including problem diagnosis and isolation, maintenance support coordination, problem resolution, and recording COTS HW/SW maintenance actions performed at the site. The LMCs are designated and managed by the ECS Manager at the DAACs, SMC, and EOC.



Shaded blocks indicate offices/persons having primary maintenance functions.

Figure 4.2-1. COTS HW and SW Maintenance Organization

4.3 ECS Maintenance Resources

The maintenance and sustaining engineering resources established at ECS sites are based upon the level of maintenance support required to achieve ECS A_o and MDT requirements.

4.3.1 Site Maintenance Resources

The principal COTS HW and SW maintenance resource at the sites is the local maintenance coordinator (LMC), who also functions as the site's maintenance engineer. The LMC coordinates COTS HW and SW maintenance actions; determines the source of the maintenance support for the failed unit; and records the problem and its resolution into management systems. The LMC may be the principal maintenance source for selected equipment having high A_o and/or low MDT requirements. As a principal maintenance source, the LMC is responsible for isolating failures to the line replaceable unit (LRU) and replacing it with an on-site spare. The LMC is immediately available, understands the ECS architecture and operational requirements, and represents a lower cost maintenance approach for certain equipment.

The principal provider of COTS HW maintenance support at the sites is determined on a site-by-site basis depending on the quantity and complexity of equipment at the site; the maintenance response required to achieve A_o and MDT objectives; and relative costs of contracted, OEM, and self maintenance. Sites with large quantities of equipment, high A_o and low MDT requirements (e.g., EOC and SMC), and/or extended hours of operation (such as GSFC) are supported by dedicated ECS maintenance engineers. For sites with less equipment, the principal provider of equipment maintenance support will be a maintenance subcontractor and the OEMs. For some equipment, the labor, training, and spares costs do not make self-maintenance a cost-effective approach. The determination of principal maintenance responsibility for each equipment item is made through analysis of requirements, capability, and costs. For Release B systems, this will occur once the Release B design is final; after maintenance bids from vendors are analyzed and negotiated; and after ESDIS approval of the maintenance source.

The LMC is assisted by the site's system and network administrators to isolate and resolve problems. The science user (for science user problems) and DAAC operators (for operator problems) initiate a maintenance action by preparing a trouble ticket using ECS-provided Remedy SW. The trouble ticket is forwarded to Operations Supervisor to assign priority and responsibility for resolution to the matrix in Table 4.3.1-1, Maintenance Responsibility Matrix.

Table 4.3.1-1. Maintenance Responsibility Matrix

Problem Source	Normally Assigned Responsibility
System or Data Base Configuration	System Administrator or Data Base Administrator (if data base problem)
Network Configuration	Network Administrator (if LAN cable or network HW is the problem the LMC resolves)
Science Software	DAAC Sustaining Engineer and/or the science SW developer
ECS Custom Software or API[1]	Sustaining Engineer or the ECS SEO
COTS Software	SEO with SW vendor support and LMC (if needed)
COTS HW	LMC contacts the OEM or maintenance contractor for on-site support unless the LMC can resolve the problem by replacing the LRU with a site spare

1 (API) application program interface

The LMC monitors trouble tickets until problems are resolved and their resolution verified. Once verified, the Operations Supervisor closes the trouble ticket and updates the Baseline Manager (if a change to the configuration baseline was required). The problem reporting, resolution, and recording process is described in detail in Operations Scenarios (DID 605) Paragraph 5.2.6. Changes to custom SW are accomplished by the DAAC sustaining engineers or the SEO using configuration management processes described in the ECS Developed SW CM Plan..

The LMC coordinates resolution of COTS HW and SW maintenance actions. If problems cannot be corrected using site or contracted maintenance support resources, the LMC can escalate the problem to the SMC, SEO, or the ILS Maintenance Coordinator, as described below.

4.3.2 SMC and SEO Support

The SMC Help Desk provides support for developed application SW, network, and design problems and monitors trouble tickets logged by the sites. Using the trouble ticketing system (Remedy) to recall similar problems, the SMC can assist the sites in problem diagnosis/resolution through reviewing previous configuration changes and problems reported against the equipment and subsystems. The SMC can also review similar problems experienced at other DAACs to identify possible causes and offer corrective actions.

Also available is the Sustaining Engineer Office (SEO), which has senior systems engineers, who are technical experts in the ECS design, equipment, and its applications, to assist in the diagnosis and resolution of site HW, SW, and network problems. The SEO provides a system-wide view to assist the site in diagnosing local DAAC problems. COTS HW or SW problems that cannot be resolved using local site, SMC, or SEO resources are escalated to the appropriate OEMs.

4.3.3 ILS Maintenance Coordinator

The ILS Maintenance Coordinator within the ILS Office assists the ESDIS Project Office to develop maintenance policy and procedures applicable to the ECS and monitors COTS HW/SW maintenance. The ILS Maintenance Coordinator performs the following functions:

a. Monitors DAAC maintenance activities and records to ensure maintenance vendor and OEM contractual obligations are being met.

b. Obtains and coordinates OEM support for COTS HW or SW problems escalated by the SMC, SEO, or LMC.

c. Obtains additional resources (e.g., OEM support), if required, to resolve maintenance problems and coordinates their delivery.

d. Monitors, evaluates, and reports ECS maintenance program performance to determine if and where adjustments are needed to improve support to the Project.

e. Establishes contracts with suppliers (through the ECS Procurement Office) for spares acquisition and replenishment.

f. Establishes, monitors, and renews HW maintenance contracts and SW licensing and support agreements (through the ECS Procurement Office). Resolves contractual issues relating to COTS HW and SW vendor/OEM support to ECS sites.

g. Serves as the ILS Manager's representative on the Failure Review Board reviewing corrective actions taken on COTS products. If a corrective action is found to be insufficient, the ILS Maintenance Coordinator may become the lead to resolve the action.

4.3.4 Maintenance Management Systems

Management of the logistics, maintenance, training, property, and facilities effort is supported by the management applications services of the CSMS. For Release A, some of the management functions are automated (e.g., fault management, configuration management, and network management). Manual Release A management functions will be transitioned to an automated capability during Release B (e.g., inventory management and maintenance management).

4.4 Maintenance Support Concept

4.4.1 Maintenance Policies and Procedures

The policies and procedures necessary for the implementation of the ECS maintenance concept will be developed by the ECS Contractor and documented in Release B Operator Manuals (611-CD-002-001). These policies and procedures will be developed through analysis of the ECS final design, the capabilities offered in the management tools comprising the design, and the ECS Operations Scenarios (605-CD-002-001), which describes the process flows and the interaction of system tools and operators. Policies and procedures are reviewed and approved by ESDIS prior to implementation at RRR. ECS sites will be expected to supplement these procedures, as needed, to address local operations requirements and to provide clarification/guidance as deemed necessary by the DAAC Managers. ESDIS policy decisions will be reflected in the Release B Operator Manuals (611-CD-002-001). That document will be updated as changes to policies and procedures occur.

4.4.2 On-Site Support

LMCs are present at all sites to support Release A and B maintenance operations. This on-site maintenance capability is provided to satisfy the operational availability and MDT requirements of ECS functions. The LMC is the principal maintenance coordinator for COTS HW and SW and may be trained and certified to perform maintenance on selected ECS equipment. Equipment that will be maintained by the LMCs will be selected after completion of the sparing and maintenance capabilities/costing analyses, to be completed prior to Release B CSR. Factors to be considered in the selection of COTS HW to be maintained by LMCs include maintenance response time required; criticality of the equipment and redundancy of components/systems; technical expertise needed to diagnosis and replace failed LRUs; and the cost of training, spares, support equipment, and alternative maintenance sources.

For equipment in which the LMC is responsible for maintaining, his responsibilities will include fault diagnostics and identification to the LRU level and replacement of failed LRUs with site spares. For equipment designated for maintenance by a maintenance contractor, the LMC escalates

the problem to the responsible contractor. For problems that cannot be diagnosed by the maintenance contractor, the LMC may escalate the problem to the SMC or OEM for further assistance in diagnosing the cause.

When a COTS HW or SW problem occurs, the system and network administrators use diagnostics tools, such as Open View, Tivoli, and operating systems diagnostics to identify and isolate the problem to the malfunctioning component, which may be SW or a failed LRU. If HW is identified as the source, the LMC or maintenance subcontractor corrects the problem by replacing the failed LRU, putting the unit back into operation, and testing the equipment and subsystem to verify the problem has been corrected. Malfunctioning COTS SW is reported to the Sustaining Engineers. COTS SW problems are diagnosed by analysis of error codes, built-in diagnostics, or the help of the SW vendor. If the problem is confirmed to be with the COTS SW, the Sustaining Engineer will work the problem with the applicable SW vendor to obtain a temporary or permanent solution (i.e., patch or temporary work around). This on-site, immediately available, maintenance support is available at the DAACs during the principal period of maintenance (PPM), which is 8AM to 5PM local, Monday through Friday, except holidays. For the EOC and SMC the PPM is 24 hours/day, 7 days/week.

The site M&O staff (sustaining engineers; system, data base, and network administrators; and LMCs) planned to support each site are identified in the ECS Operations Plan (DID 608). The site M&O staff may be unable to resolve some of the more difficult maintenance problems. For this reason, backup support is available from a number of sources, including the SMC, SEO, maintenance subcontractors, and OEMs. The LMC, following local procedures and ECS policy, determines if backup support is required based upon the nature of the problem. Network and SW-related problems may be referred to the SMC for assistance, while HW problems are normally referred to the responsible maintenance subcontractor or OEM for resolution.

4.4.3 Sustaining Engineering Office (SEO) Support

The Sustaining Engineer Office (SEO), which is co-located with the SMC, has resources available to assist the sites in diagnosing problems related to the configuration of ECS subsystems, the ESN, and ECS applications. Using the diagnostics and monitoring capabilities of the enterprise management system (i.e., HP's Open View) and the fault management system (the Tivoli Management Environment), the SEO can identify recent indications of problems with the network and subsystems. The SEO can also obtain support from ECS development resources, who are experts on the design and functions of the equipment and the SW. The SEO can also assist by identifying a work-around to reestablish operational capabilities.

Problems attributed to ECS developed applications and science SW are referred to the DAAC's Sustaining Engineers or the SEO. Maintenance of ECS developed SW and science SW is addressed in the ECS Developed Software Maintenance Plan (DID 614).

4.4.4 Backup Maintenance Support

Back-up maintenance support is available from COTS OEMs and maintenance subcontractors on an on-call basis. If on-site personnel and the SEO have not resolved the problem, additional HW maintenance support can be provided by an on-call maintenance subcontractor or the OEM. This

on-call maintenance capability is the first level of maintenance support for most ECS equipment. On-call maintenance subcontractors and OEMs are also available outside the PPM, generally on a time-and-materials basis. Because of the high cost of support outside the PPM, its use should be used by the site LMC only when a required ECS function cannot be performed or the function's performance is degraded to the extent that DAAC processing or distribution operations are or will become seriously backlogged.

The ILS Maintenance Coordinator negotiates the terms and conditions for backup maintenance coverage of COTS HW and SW by maintenance subcontractors and OEMs based on Project needs. Subcontractor and OEM maintenance personnel must acknowledge their presence to the site's LMC before commencing work on ECS equipment and report maintenance actions performed and parts replaced to the LMC prior to leaving the site.

4.5 Preventive Maintenance (PM)

Advances in technology has eliminated most PM requirements except for routine cleaning, normally performed by the operator. Except for the robotics archive systems, Release B equipment has no requirements for scheduled preventive maintenance (PM). Preventive maintenance of robotics systems will be scheduled in the Inventory, Logistics, and Maintenance (ILM) subsystem (i.e., XRP II) and its completion recorded. The LMC will coordinate PM of the robotics system with the Operations Supervisor to avoid downtime of DAAC operations. PM of the robotics systems will not be entered as a trouble ticket unless the data archive functions must be shut down. In such cases, the trouble ticket will record the time the system was shut down and restarted and the reason for the shutdown. Maintenance personnel will inspect equipment during corrective maintenance for evidence of impending failures and clean, repair, or replace any affected LRUs, as appropriate.

There are currently no requirements for the calibration of ECS equipment, other than the robotics data archive system, which is the responsibility of the OEM. Requirements for calibration of tools, gages, or equipment used in the test and inspection of ECS hardware will be performed and recorded in accordance with guidance contained in the Performance Assurance Implementation Plan (DID 501).

4.6 Corrective Maintenance

Corrective maintenance actions include fault detection, diagnosis, isolation, and resolution through replacement of failed LRUs. Removal and replacement of failed LRUs is performed without the need to interrupt the critical operations of the ECS. Failed LRUs are replaced with site spares, if available, or with LRUs provided by the maintenance subcontractor or OEM. Replacement LRUs will be the same make and model as the original LRU or a suitable substitute that has the functionality, performance, and interfaces equal to or exceeding that of the original item being replaced. In the event a substitute item is used, ECS configuration management policies apply and the subsystem or component will be re-tested according to the ECS Test Management Plan/Procedures.

4.6.1 Fault Diagnostics and Problem Isolation

COTS operating systems, communications equipment, and peripherals generally have significant diagnostics capabilities built in to facilitate fault diagnosis to the equipment LRU. Such tools are used to expedite problem resolution, reduce maintenance downtime, and minimize the need to call in outside maintenance support.

4.6.2 Maintenance Response Time

Maintenance response requirements consider the criticality of the HW, SW, and functions supported; location of the maintenance resource; site operations hours; and relative response costs. Responses to COTS HW or SW malfunctions are initially provided by the LMC, site maintenance subcontractor, or OEM. Response time of on-site LMCs is normally less than 10 minutes. Third-party maintenance providers and OEMs under maintenance subcontract are required to be on-site within 4 hours after being notified of an equipment failure during the principal period of maintenance (PPM). Generally, response for contracted maintenance support outside the PPM is provided on an as-available basis, generally within 6 hours. If failures occur outside the PPM, the site should consider deferring OEM or maintenance subcontractor response until the next day if the malfunctioning system is not critical to ECS operations. This includes maintenance actions that would extend outside the PPM hours. Critical ECS systems are those that support EOC or SMC critical functions defined in Section 3.3 above.

4.6.3 Spares Provisioning

Spare parts are provisioned at the sites to ensure replacement LRUs are available to effect the immediate repair of failed equipment. Recommendations to the ESDIS Project Office regarding spares quantities and locations will be presented to the ILS Management Team at provisioning conferences and submitted for approval 1 month prior to the Release Readiness Review (RRR). These recommendations are documented in the Replacement and Spare Parts List (DID 618). Spares stocking levels may be adjusted after sufficient failure data is gathered during ECS operations to warrant adjusting site spares quantities and types.

Site spares are limited to LRUs that can be replaced by the LMC or LRUs necessary to insure that critical systems do not experience down time because the maintenance contractor is out of stock. Such spares provide a cost effective solution to meeting the A_O and MDT requirements of ECS. Site spares are the reparable and non-reparable repair parts (i.e., LRUs) required to replace failed equipment components in order to bring systems back to full operating capability. Spares used at the sites are reported to the ILS Maintenance Coordinator, who will replenish site stocks, as needed. The use and replenishment of site spares is monitored by the ILS Maintenance Coordinator.

4.6.4 Non-Reparable Spares Replenishment

Replacement parts used in the repair of ECS equipment under maintenance contract by a third-party maintenance subcontractor or OEM are normally provided by the maintenance provider. In cases where the maintenance provider cannot readily obtain the required replacement part, site spares may be used to effect essential repairs, but will be replaced at the earliest possible date by the maintenance provider.

Until the inventory management capabilities of the Configuration Management Services system are available at Release B, sites will report, via Internet message to the ILS Maintenance Coordinator, the use of site stocks of non-reparable spares. The message should identify the related trouble ticket and the specific part number, part name, and make and model of the end item in which the part was obtained. The ILS Maintenance Coordinator monitors non-reparable spares use and replenishes them, as needed, to bring site quantities to the recommended stock levels. Sites will dispose of non-reparable spares following procedures described in the ECS Property Management Plan (DID 602).

4.6.5 Reparable Spares Replacement

Sites replace reparable spares by sending the failed LRU to the responsible maintenance source (i.e., OEM or maintenance subcontractor), which will replace them with new or repaired and tested LRUs of the same make and model. Maintenance sources will use expedited shipping (i.e., next day air) to return replacement/repaired LRUs to sites to minimize the time in which the site is without a spare LRU.

Failed reparable LRUs replaced with site spares will not be repaired by the ECS contractor, but are forwarded by the LMC to the appropriate vendor or OEM for component level repair. Such returns will be shipped within the next business day after obtaining a Return Authorization number from the maintenance source. Generally, provisions will have been made with vendors/OEMs that will result in the shipment of a replacement LRU to the site while the failed unit is en route to them. The OEMs determine whether their equipment LRUs are reparable based on repair and replacement costs. When a failed LRU is returned to the OEM or vendor, it is repaired, tested, and certified as fully operational and then returned to stock in like-new condition. Failed LRUs replaced by the maintenance subcontractor or OEM from their stocks, become their property. Appropriate adjustments to ECS property records are made by the local property administrator at the time of the maintenance action.

4.6.6 Vendor- and OEM-Stocked Spares

In some cases the maintenance vendor or OEM may stock spares on or off site to support ECS maintenance operations. In such cases, the quantities, locations, and types of spares will be determined by the vendor or OEM. Storage, transportation, and repair/replacement charges will be per agreements reached with the vendor/OEM.

4.7 COTS Software Maintenance

The ILS Maintenance Coordinator establishes SW maintenance support contracts with COTS SW providers to assist ECS sites and the SEO in the resolution of SW problems. COTS SW problems are reported to the responsible SW vendor for resolution. If the SW vendor is unable to provide an immediate patch to resolve the problem, the SEO can attempt to provide a temporary work-around solution until a more permanent resolution (i.e., patch) is provided by the SW vendor. The SEO coordinates and monitors such efforts.

4.8 COTS HW and SW Problem Resolution Process

ECS sites are provided the resources to manage and resolve the majority of SW, HW, network, and developed applications problems. This local capability, comprised of a System Administrators, Network Administrator, Data Base Administrators, Sustaining Engineers, LMC, and a local maintenance subcontractor, is depicted in Figure 4-2, "Local Site Maintenance Support". The site LMC coordinates the day-to-day COTS HW and SW maintenance actions at the DAACs, SMC, and EOC.

COTS HW or SW malfunctions are referred to the LMC, system administrator, or network administrator, as appropriate for the type of suspected malfunction. These resources, acting as a team or independently, investigate and attempt to resolve the problem. Initially, through discussion with the operator or user, they will attempt to diagnose and isolate the source of the problem. Problems may be any one of the following; user/operator error, developed application or interface problem, system or network configuration problem, or COTS HW or SW malfunction. If the problem is related to a developed application, system configuration, or the network configuration, the site sustainment engineer, system administrator, or network administrator will take corrective action to resolve the problem. Where equipment or component redundancy exists, the operations staff will switch processing over to the redundant equipment or component to restore the system to operation.

For problems confirmed to be attributed to COTS HW failure, the LMC determines if the item is under warranty or maintenance contract. Items under warranty are repaired or replaced only by the OEM or HW vendor to comply with the terms of the warranty agreements. Items in which the warranty has expired are repaired or replaced by the responsible maintenance provider or the LMC, depending upon who is designated as the principal maintenance source for the item.

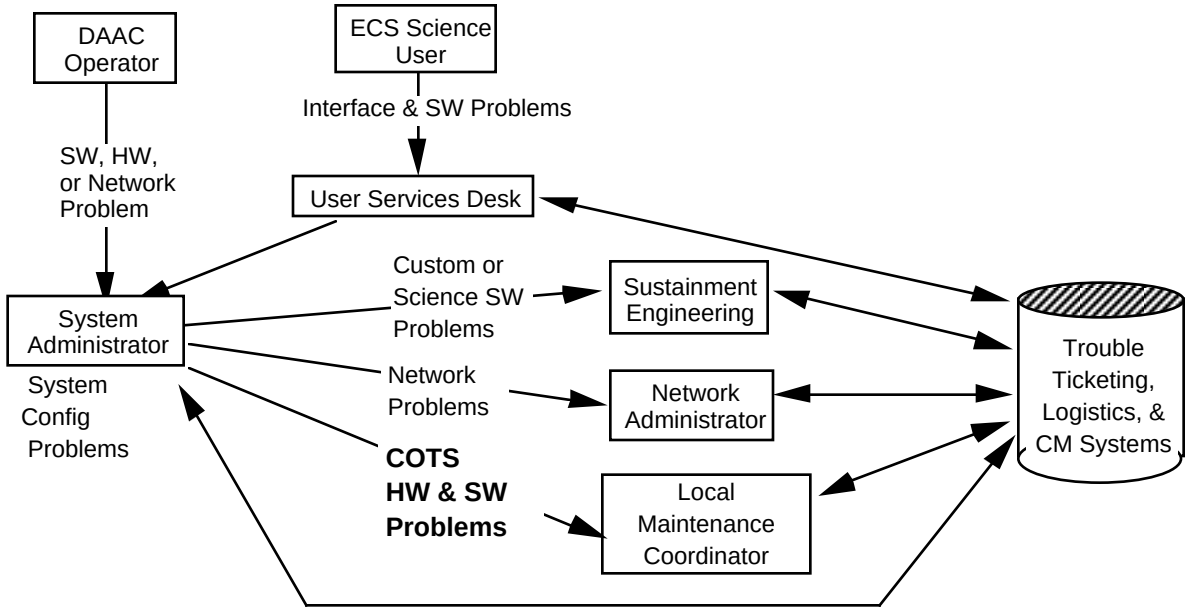


Figure 4-2. Local Site Maintenance Support

COTS SW problems are forwarded to the COTS SW developer for resolution, either through provision of a temporary work-around, patch, or correction of the problem in the next SW release. Problems in which the site cannot isolate the cause to specific COTS HW or SW can be escalated to the SMC Help Desk, as described earlier in Section 4.4.2.

In all cases where a science user has reported a problem, the User Services Desk will keep the user informed of the status of its resolution.

4.9 Escalation Procedures

ECS sites will establish parameters and instructions for escalating problems to the SMC and the ILS Maintenance Coordinator. The SMC, using its diagnostic and engineering resources, will assist the site in diagnosing the cause of the problem and in developing a solution. The SMC will determine if the problem needs to be escalated further to the equipment manufacturer or software developer. Malfunctions that are preventing the accomplishment of a critical operations function are immediately reported to the M&O Manager.

4.10 Maintenance Reporting

Trouble tickets are used to record ECS HW and SW malfunctions. They can be initiated by the User Services Desk, the LMC, or any of the operations personnel at the site. Trouble tickets are on-line and accessible by the site operations personnel, the LMC, SMC Help Desk, ILS Maintenance Coordinator, and the ECS development organization at the EDF. Trouble tickets are updated when there is a change in status, when it has been routed to a new action, or when the problem is escalated. As problems are resolved, the corrective action taken is entered and the Trouble ticket closed by the Systems Administrator, Network Administrator, or the LMC.

The ILS Maintenance Coordinator monitors COTS maintenance actions by periodically reviewing the trouble tickets. In addition, the ILS Maintenance Coordinator is alerted via the escalation notification procedures of aging trouble tickets.

4.10.1 Maintenance Analysis

The trouble ticketing system (i.e., Remedy) will contain the history of COTS HW and SW malfunctions, thereby providing traceability for COTS HW and SW malfunctions and corrective actions. Trouble tickets are analyzed by the ILS Maintenance Coordinator to identify failure trends, to assess whether A_O and MDT objectives are being achieved, and to ensure that contractual obligations are being met.

4.10.2 External Maintenance Reporting

Trouble tickets will be provided monthly to NASA using procedures of DID 529, Malfunction/Failure Report, as a guide. Five working days after the end of the month, information from all trouble tickets that are open at the end of the previous month will be downloaded from the trouble ticketing system and placed on MS-DOS compatible DS/DD 3.5 inch floppy disks in ASCII format for delivery to NASA Code 505.

Information included in trouble tickets includes number, problem description, date of problem, equipment, location, actions taken, results of actions taken/proposed action, and estimated closure date. When trouble tickets are closed, the next month's report to NASA will identify the closure information. Information previously provided to NASA as an open trouble ticket is also included, along with any new corrective actions. The closure action and date is displayed adjacent to the malfunction date. The closure information on the trouble ticket will include a reference of all actions taken to correct the malfunction. This includes such data as the reference documentation containing corrective action guidance and HW or SW documentation information providing specifications, part number, model, and serial number.

4.10.3 Tools and Test Equipment

COTS equipment maintenance is accomplished using tools and test equipment comparable to that recommended by the OEM. Release B equipment planned for maintenance by ECS personnel (i.e., LMCs) requires no special tools or test equipment, as documented in the document "Special Maintenance and Test Equipment "(DID 615). Any standard or special support equipment required to test ECS systems prior to being returned to operational service will be documented in DID 619, "Test and Support Equipment Requirements," to be delivered prior to Release Readiness Review.

4.11 Government Furnished Equipment

Currently, no Government Furnished Equipment has been assigned to the ECS contractor for maintenance responsibility. However, if the Government later directs the ECS contractor to maintain such equipment, the terms for that support will be negotiated on an individual item basis.

4.12 Property Reporting

All ECS COTS equipment and SW is accountable to the ECS contractor, specifically the ILS Office. When an ECS component containing an ECS property tag is replaced, LMCs will remove the tag from the replaced item, apply a new tag to the new unit, and record both the old and new equipment identification numbers (EINs) in the trouble ticket.

Replacement of an equipment component with a like component from the site spares kit will be noted on the trouble ticket along with the model and serial numbers of the replacement unit. The LMC will update the site's inventory record and route the failed unit in accordance with the ECS Property Management Plan (DID 602). Equipment that does not require an equipment identification number will have a 1-inch circular ECS property tag affixed. Property tags will be affixed by the LMC in accordance with procedures specified in the ECS Property Management Plan .

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5. Configuration Management and Data Management

5.1 Configuration Management

Throughout the course of ECS releases, frequent changes in the configurations of equipment (models, LRUs, components, specifications) and SW will occur. This requires control of all changes in HW and SW to ensure traceability to the original configuration baseline. COTS documentation will likewise undergo numerous revisions to reflect systems changes. This data will accurately reflect past and current status of COTS equipment.

Maintenance of COTS HW and SW is performed in compliance with the M&O Configuration Management Plan and ECS Configuration Management Procedures. To maintain control of the COTS equipment environment (operation, maintenance, LRUs, technical documentation), changes are controlled and documented over the life of the ECS. Changes to COTS HW and SW configurations resulting from maintenance actions are documented in trouble tickets and configuration change requests (CCRs) and reported to the site CM manager for entry into the Baseline Manager system.

At the time that COTS HW and SW is installed at a site, the operational baseline for the site is established and recorded in the Baseline Manager. Subsequent to that installation, changes resulting from maintenance actions are recorded in trouble tickets and CCRs and entered into the Baseline Manager database to update the configuration record.

COTS equipment and SW, consisting of many HW models and SW versions and releases, will be obtained from many vendors. Vendor-issued changes and updates will be approved by the appropriate CCB prior to implementation.

The ECS contractor will obtain licenses to permit use and upgrades to COTS SW. Licenses are retained and maintained current by the ILS Maintenance Coordinator. Site-specific controls for COTS SW installed at operational sites are specified by the local site CCB. COTS SW upgrades will be tested to ensure COTS compatibility prior to implementation.

Plans to install COTS SW revisions or patches will be brought before the SW CCB. Updates to the Baseline Manager will record the implementation of any such change in the ECS operational environment. The SW Configuration Management Plan describes the procedures for control and modification of COTS SW.

The site LMC is responsible for the site master copy of COTS SW. It will be used for back up and maintenance purposes, as required. The master SW copy will be maintained at the most current level in accordance with the ECS Configuration Management Plan (DID 102).

5.2 Document Management

Document management is accomplished in compliance with the ECS Document Management Plan and the Document Management Procedures. DAACs will establish and maintain a technical reference library that includes COTS HW, SW, and firmware documentation relevant to the site configurations in accordance with the ECS Document Management Plan. DAACs will update COTS-related documents (schematics, operator or technical references, maintenance manuals, etc.) as up-dates are received.

The site's document manager controls and updates technical and user documentation whenever OEMs issue new technical manuals or revisions to existing documents. As new or updated documents arrive at a site, the document manager will update the documentation to reflect the most current applicable version. The documents will be kept in a controlled master library for use as reference or for producing copies, if authorized. The document manager will record all revisions in accordance with the Data Management Plan.

6. Certification and Training

6.1 Certification

ECS maintenance personnel are certified prior to permanent assignment. Certification is the verification through written, oral and/or performance evaluation, that an individual meets the minimum level of proficiency necessary to perform the duties associated with a system/subsystem or position. The specific details of the M&O certification program are contained in the M&O Certification Plan (DID 626, estimate publication 11/96).

Certification criteria for maintenance functions will be recorded in certification skills catalogs. The maintenance engineer position will have a catalog associated with the function. The catalog will contain a list of the skills and knowledge which define job proficiency in the function. The ILS Maintenance Coordinator establishes the certification criteria for maintenance personnel.

Maintenance vendor's will provide certified personnel to ECS and maintain records for training provided and tests administered. Training and certification records maintained by maintenance vendors are subject to review by the ILS Maintenance Coordinator upon request.

6.2 Recertification

Maintenance personnel are re-certified annually. ECS site managers may direct rectification prior to the annual date in cases where job proficiency of an individual has declined, or when changes in system design or technology have established new performance criteria. Responsibilities for re-certification are the same as those for certification.

6.3 Training

It is the responsibility of maintenance vendors to provide the training necessary for their personnel to meet the certification criteria. Maintenance training should contain course objectives that match the certification criteria established.

Training of ECS Contractor maintenance personnel is performed in accordance with the ECS Training Plan, 194-622-OP2-001.

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7. Safety

7.1 Safety

The ECS System Safety Implementation Plan is referenced in Section 6 of the ECS Performance Assurance Implementation Plan (PAIP), 501-CD-001-004. It provides guidance in establishment of safety practices, standards, and procedures applicable to COTS maintenance and operations personnel. Safety requirements are to be updated on a continuing basis and in compliance with all related federal, state, and local laws and regulations, and emergency procedures.

7.2 Policies and Procedures

The policies contained in the System Safety Implementation Plan and the guidelines and procedures contained in the Contractor's "Manual of Safety and Environmental Health" will be used to implement safety practices during planning and implementation of COTS HW and SW maintenance support actions. The emphasis of maintenance safety will be to protect ECS and user personnel from inherent or accidental equipment or system safety faults in addition to protecting the system from damage.

7.3 Maintenance Input

The ILS Office will provide COTS HW and SW maintenance safety input to the System Safety Implementation Plan when the results of various analysis reveal an actual or potential safety impact. These analyzes will be from the failure modes, and effects analyses (FMEA), maintainability analysis, availability analysis, training requirements, and certification analysis. The results of the critical item portion of the FMEA will be provided to the quality assurance organization for consideration for inclusion in the System Safety Implementation Plan.

7.4 Electrostatic Discharge

Control of electrostatic discharge (ESD) will be a subject for the Environmental Control Plan (DID 532). The Environmental Control Plan sets policy for an awareness program of ESD and addresses maintenance practices that are to be followed to eliminate ESD hazards to HW, SW, or people. Procedures for the program will be developed in accordance with DOD-HDBK-263 and DOD-STD-1686 guidance. Included in the program will be policies and procedures for prevention and safe dissipation of static electricity; workplace common grounding requirements; and parts handling and protection when in storage, outside the manufacturer's protective packaging, and being readied for installation or removal. ESD hazard awareness and prevention will be an element in the training and certification process of ECS operations and maintenance personnel. All ESD hazard awareness and prevention requirements will be passed through as requirements to all operations or maintenance subcontractors.

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Abbreviations and Acronyms

A_o	Operational Availability
API	Application Program Interface
ASF	University of Alaska Synthetic Aperture Radar (SAR) Facility
CCB	Configuration Control Board
CCR	Configuration Change Request
CDR	Critical Design Review
CDRD	Contract Data Requirement Document
CDRL	Contract Data Requirements List
CM	Configuration Management
COTS	Commercial Off-the-Shelf
CSMS	Communications and Systems Management Segment
CSS	Communications subsystem
DAAC	Distributed Active Archive Center
DID	Data Item Description
DM	Data Management
ECS	EOSDIS Core System
EDC	Earth Resources Observation Systems (EROS) Data Center
EDF	ECS Development Facility
EIN	Equipment Identification Number
EOC	EOS Operations Center
EOS	Earth Observing System
EOSDIS	Earth Observing System (EOS) Data and Information System (DIS)
EROS	Earth Resources Observation Systems
ESD	Electrostatic Discharge
ESDIS	Earth Science Data and Information System
ESN	EOSDIS Science Network

FMEA	Failure Modes, and Effects Analyses
FOS	Flight Operations Segment
GFSC	Goddard Space Flight Center
HW	Hardware
IDR	Increment Design Review
ILS	Integrated Logistics Support
ILSO	ILS Office
IMS	Information Management System
ISS	Internetworking Subsystem
IST	Instrument Support Toolkits
JPL	Jet Propulsion Laboratory
LaRC	Langley Research Center
LMC	Local Maintenance Coordinator
LORA	Level of Repair Analysis
LRU	Line Replaceable Unit
LSA	Logistics Support Analysis
M&O	Maintenance and Operations
MDT	Mean Down Time
MSFC	Marshall Space Flight Center
MSS	Management Subsystem
NA	Network Administrator
NASA	National Aeronautics and Space Administration
NSIDC	University of Colorado, National Snow and Ice Data Center
OEM	Original Equipment Manufacturer
OPPM	Outside PPM Hours
ORNL	Oak Ridge National Laboratory
PAIP	Performance Assurance Implementation Plan
PHS&T	Packaging, Handling, Storage, and Transportation
PM	Preventive Maintenance

PPM	Principal Period of Maintenance
RMA	Reliability, Maintainability, and Availability
SA	System Administrator
SAR	University of Alaska Synthetic Aperture Radar
SDPS	Science Data Processing Segment
SEO	Sustaining Engineering Office
SMC	System Monitoring and Coordination Center
SOW	Statement of Work
SW	Software
TOO	Target of Opportunity
TT	Trouble Ticket
UPS	Uninterruptable Power Supply

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